Space Weather Technical Forecast

Issued on Monday 21 October 2024 at 13:29 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: Chance of G1/Minor Geomagnetic Storms day 1 and 2 (21 and 22 Oct). Increasing chance of Radio Blackouts this week.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity observed at GOES16 and 18 was Low. There are eleven sunspot regions on the disc. Despite the large number of sunspots present, most are small with limited magnetic complexity. AR3863, the largest sunspot group, located in the southeast quadrant underwent some modest growth in the intermediate and trailing portion of the group, but remained largely inactive. AR3859, in the southwest decayed in terms of areal extent, but saw some consolidation of the spots in its intermediate region. New regions AR3864 and 3865 in the eastern hemisphere were both numbered.

The largest flare of the period was measured at C6.2 at 21/1000 UTC from a region just beyond the eastern limb.

There has been a data outage of SOHO C2/C3 since 20/1412Z and only very limited coronagraph imagery has been available since then. STEREO A COR2 has been available during the period, but does not indicate any Earth-directed CMEs.

Solar Wind / Geomagnetic Activity: Solar winds speeds, as observed at L1 by ACE, declined steadily from a peak of around 400km/s to around 350km/s by the end of the period. The solar wind density was generally Below Average. The IMF, Bt, was Weak throughout, with a peak of nearly 6nT at 21/1059 UTC. The north-south component, Bz, varied Weakly. The phi angle was broadly negative (towards the Sun). Geomagnetic activity was Quiet.

Energetic Particles / Solar Radiation: High energy proton flux observed by GOES18 was at Background levels.

High energy electron flux (greater than 2MeV) observed by GOES16 was mainly at Normal Background levels. The associated 24-hour fluence was well below the Active threshold. The 21/0001UTC observation was 3.37e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low, with a chance of Moderate activity from isolated M-class flares initially. Activity likely increasing through the period with the return of several notable active regions over

---

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

the eastern limb, probably becoming Moderate by day 3 (23 Oct), with a slight chance of becoming High, given an increasing probability of isolated X-class flares occurring.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs in the forecast. Solar winds are currently at Background levels, however a connection to the fast wind from CH82/+ is expected either from very late on day 1 (21 Oct), or more likely during day 2 (22 Oct). Consequently, solar winds should increase to between Slightly Elevated and Elevated levels. This enhancement is likely to bring Active intervals with a high Chance of peak Minor geomagnetic storm (G1) conditions, before activity declines to Quiet to Unsettled levels through days 3 and 4 (23 and 24 Oct).

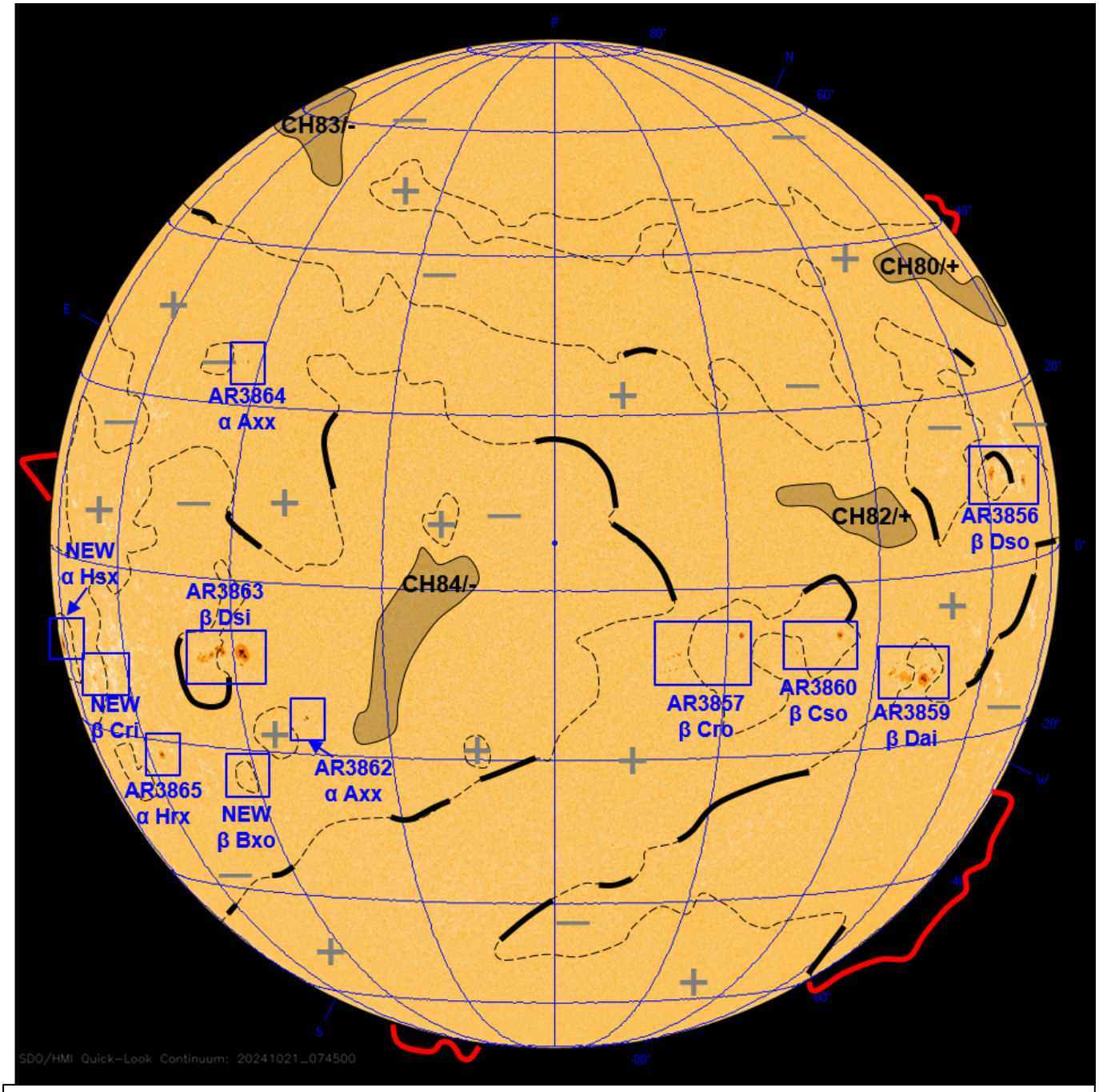
Energetic Particles / Solar Radiation: High energy proton flux at GOES18 is Expected to remain at Background levels.

High energy electron flux at GOES16 is forecast to remain mainly Background to Moderate levels with the associated 24-hour fluence Expected to remain below Active (1e8 total pfu) throughout.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 1: MOSWOC Solar Synoptic Map valid 21/0745 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Geomagnetic Storms

There has been a data outage of SOHO C2/C3 since 20/1412Z and only very limited coronagraph imagery has been available since then. STEREO A COR2 and HI1 has been available during the period, but does not indicate any Earth-directed CMEs.

Solar winds are now at normal Background levels following a minor enhancement from CH80/+ in recent days. The next enhancement is likely to be from the onset of fast winds from CH82/+. This is a recurrent, but smaller feature compared to the previous rotation, but due to its more equatorial location has a high likelihood of connection to Earth. The anticipated arrival for any CIR region is expected either late on day 1 (21 Oct) or more likely during day 2 (22 Oct). A period of Slightly Elevated to Elevated solar winds is then expected to follow. Given that peak G1 Minor Storm intervals were observed on the previous rotation associated with this enhancement, similar is possible on this occasion. MOSWOC ENLIL model output does show a weak enhancement possibly associated with this feature, however this is later (in model space) than currently anticipated given the coronal hole's location, and not considered as good guidance.

Geomagnetic activity is forecast to be Quiet to Unsettled initially. Fast wind onset from CH82/+ is then expected to bring Active to G1 Minor Storm intervals, perhaps from very late on day 1 (21 Oct), but more likely on day 2 (22 Oct). Activity is expected to decline to Quiet to Unsettled levels through days 3 and 4 (23 and 24 Oct).

Geomagnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	10	50	20	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Radio Blackouts - X-Ray Flares

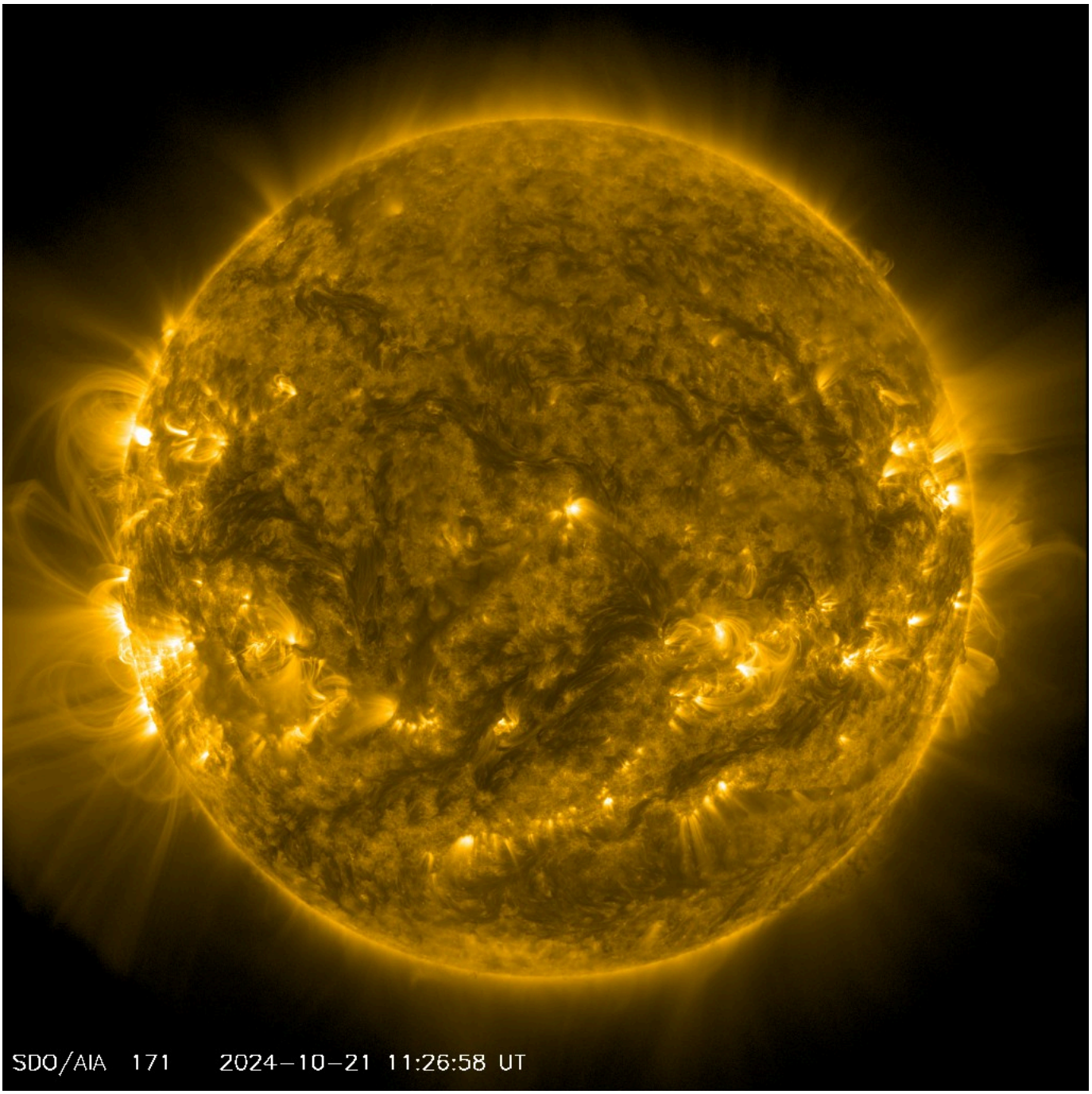
The chances of further Moderate activity from Ex-AR3854 over the western limb has significantly reduced, although bright magnetic looping just about remains evident in SDO AIA171 imagery. In their current configuration, the existing eleven sunspots on the visible disc give a chance of Moderate solar activity with isolated M-class flares possible; these most likely from AR3859 and AR3863. Activity is expected to increase in the coming days, as recurrence, recent CME activity, and far-side sounding data all suggest the return of several active regions that were present on the disc earlier in October. Bright looping is evident near the eastern limb in SDO AIA171 imagery, with recurrence suggesting the eventual return of Ex-AR3842, previous source of several strong flares (including X9.0 flare on 03 Oct), into day 3 (23 Oct). As such activity is expected to increase to become generally Moderate, with M-class flares likely, and an increased, but still slight chance of isolated X-class flares, dependent on the size and configuration of the regions once they become apparent in coronagraph imagery.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	No	40	50	60	60
Very Active	R3-R5 (X Class)	No	5	5	10	10

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 2: SDO/AIA 171 imagery valid 21/1126UTC, indicating magnetic looping associated with Ex-AR3854 over the W limb, as well as significant brightening from oncoming region/regions approaching the E limb.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Solar Radiation Storms (High Energy Protons)

High energy proton flux at GOES18 is expected to remain at Background levels. There is only a very Slight Chance of a significant enhancement, with limited flare activity observed from the regions currently on the visible disc.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

High Energy Electrons (≥ 2MeV)

High energy electron flux (greater than 2MeV) as observed by GOES16 has mainly been at Normal Background levels, with only brief incursions above the Moderate threshold at diurnal peak. The expected onset of fast winds from central disc CH82/+ on day 1 (21 Oct) or more likely on day 2 (22 Oct) is expected to suppress flux values at GEO for a time, but with an eventual chance of rising back towards Moderate, or perhaps High levels into day 4 (24 Oct).

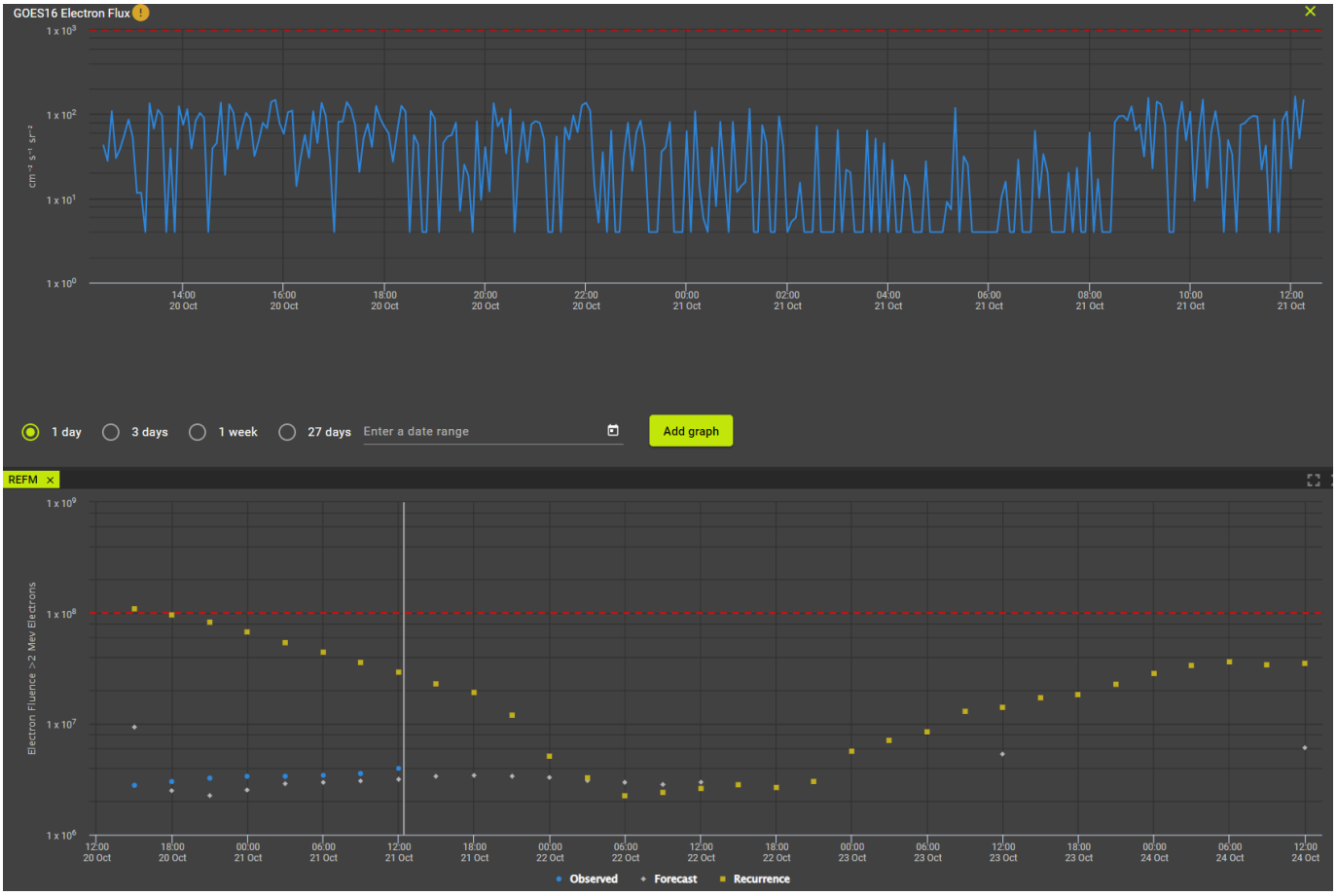
The associated 24-hour fluence is currently expected to remain below Active throughout the period, with MOSWOC REFM thought to be providing good guidance.

GEO Electron Environment Probability (Exceedance)	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ 1×10^{8}**	No	1	1	1	5
Very Active	**≥ 2 MeV ≥ 1×10^{9}**	No	1	1	1	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 3: Latest GOES16 >2MeV Electron Flux (above) and MOSWOC REFM forecast and Recurrence (below). MOSWOC REFM forecast output is thought to be a good guide at this time.



© Crown Copyright 2024. All Rights Reserved.